

Health Care Utilization in the Years Prior to Death

NORALOU P. ROOS,
PATRICK MONTGOMERY,
and LESLIE L. ROOS

University of Manitoba

THE IMPACT OF AN AGING POPULATION ON THE health care system is a primary preoccupation of health care planners. The scenarios appear bleak with a projected 300 percent increase in health care costs for the Canadian elderly by the year 2026 (Gross and Schwenger 1981), and similar marked escalations are projected for the United States (Rice and Feldman 1983).

Many aspects of the elderly's use of health care services, however, are not well understood. Much of the elderly's health care utilization appears actually to be usage associated with dying rather than aging per se, with a large proportion of expenditures occurring in the last few months prior to death (Scitovsky 1984; Lubitz and Prihoda 1984; McCall 1984). Given the dramatic differences in usage patterns between elderly decedents and survivors, will declines in elderly mortality rates offset projected increases in health care expenditures due to the aging of the population (Fuchs 1984)? Furthermore, most of the literature on health care usage prior to death has focused on hospitalization. The effect of dying on nursing home use and physician services is less well understood. Research focusing on the total health care usage is important, since studies to date suggest that those dying at older ages have less expensive rather than more expensive deaths (Lubitz and Prihoda 1984). These researchers acknowledge that their findings

may be biased since studies based on Medicare data typically only capture 56 percent of the elderly's expenditures on physician services and 3 percent of the expenditures on nursing home services (Fisher 1980). Finally, "mean" or average health care usage figures are deceiving. In the United States, 5 percent of the decedents account for 27.3 percent of Medicare reimbursements (Riley et al. 1986), so it is important to examine the entire spectrum of health care usage. In fact, there has been growing interest and controversy over the numbers of elderly who die "natural deaths"—or at least those who use few health services prior to death.

This article uses data from a large representative sample of individuals aged 45 years and older in Manitoba, Canada, to describe usage in the four years prior to death, rather than in the two prior years which has been characteristic of the best of the previous efforts (Lubitz and Prihoda 1984). All health care utilization, including acute and chronic hospitalization, nursing home stays, and ambulatory physician contacts, is first reviewed. Comparisons between utilization of decedents and other representative groups are made. Then the following issues are addressed:

1. Will a decline in elderly mortality rates offset projected increases in health care expenses due to the aging of the population?
2. Does a review of total health care use suggest that those dying at older ages have less expensive deaths?
3. What is the size of the low-user group, those whose deaths have few consequences to the health care system?

Method

To obtain representative data, a probability sample of 60,000 individuals aged 45 years and older (stratified by age, sex, and place of residence) was drawn from the 1974 registry of the provincial universal health insurance plan. Between July 1974 and June 1976, 4,561 of these individuals were recorded on the provincial registry as dying. All decedents not covered by the provincial insurance system during the full four years prior to death were excluded (248). Additional cases (50) were excluded as possible errors because they showed no contact

with the health care system in the four years prior to death and proof of death could not be confirmed in the vital statistics file. Thus, a total of 4,263 decedents were studied.

Two comparison groups were used. The first group was the entire sample of 60,000 including decedents (general population). The second group (survivors) included only those from the 60,000 sample known to be alive in June 1980. This latter group is included to estimate usage rates unaffected by utilization associated with fatal illness. Individuals not fully covered in the insurance system over the study period were excluded, leaving 52,394 (general population) and 38,579 (survivors) cases respectively. For the analyses all data were reweighted by the sampling proportions to reflect actual population usage figures.

The use of the health care system during the four years prior to death (and during a representative one-year period for the comparison groups) was determined. In Manitoba, health care utilization claims are filed routinely by hospitals (both acute and chronic treatment institutions), nursing homes, and physicians with the government agency responsible for administering the universally insured medical, hospital, and nursing home programs. The medical and hospital data have been described elsewhere (Roos et al. 1982); all tests to date suggest that the data base provides an accurate, reliable, and valid representation of health care utilization. The absence of deductibles or copayments, coupled with the physicians' natural inclination to claim for service and the hospitals' need to justify budget requests, limits the likelihood of underreporting. Regular audits asking patients to confirm the receipt of services and the monitoring of physician patterns of practice profiles discourage overreporting of services. Since Manitoba residents are reimbursed for physician visits and hospitalization which occur outside the province, Manitobans also have every incentive to report any out-of-province utilization to the Health Commission.

The nursing home program was universally insured in July 1973. All those resident in nursing homes at the time were automatically covered and enrolled in the program as of that date. After July 1, 1973, individuals could enter only if (1) assessed as requiring such care by their personal physician as well as a nurse or social worker or both, and (2) this assessment was upheld by a panel consisting of a physician, nurse, and social worker. All levels of long-term institutional care, from relatively light to heavy care are included in this coverage. Although by far the largest proportion of nursing home residents

would be classified as requiring intermediate care or skilled nursing facilities in the United States, some elderly admissions to the lightest care level might be accommodated in the United States in residential care. The date of actual admission to a nursing home was obtained for most of those enrolled as of July 1973. Nursing home use prior to the beginning of the insurance program, however, may be slightly underestimated.

Cause of death was derived from vital statistics records where available (Roos, Wajda, and Nicol 1986). In 5.6 percent of the cases vital statistics data could not be linked to Manitoba Health Services Commission (MHSC) records. For those individuals with no cause of death who died in hospital (30), cause of death was inferred from their primary discharge diagnosis.

To estimate the impact of changing mortality rates on projections of health care expenditures, we used age and sex-specific death rates for the years 1976 and 2000 obtained or extrapolated from data presented by Rice and Feldman (1983). Estimates of the number of Manitobans in 1976 and the year 2000 by age/sex group were also available (Statistics Canada 1980). Using the 60,000 sample, we determined age and sex-specific utilization rates for the period July 1974 through June 1975 separately for survivors and for decedents. The mean hospitalization rate for 1976 was calculated as a composite of total usage by decedents plus total usage by survivors divided by the numbers of individuals in the population (see appendix). This mean rate is that typically used for making projections (Rice and Feldman 1983). Two separate projections of health care use in the year 2000 were then made based on the 1976 utilization data; the first estimate was made by multiplying the decedent utilization rate times the number of individuals estimated to die in the year 2000 plus the survivor rate times the number of individuals estimated to be alive in the year 2000. The second estimate was made using the mean utilization rate (without distinguishing decedent or survival status) and multiplying this rate times the population projected for the year 2000.

Least-squares regression was used to estimate the number of years before death necessary to detect the influence of impending death on health care use. The natural logarithm of the number of hospital days (and the number of days spent in a nursing home) in 1973 was used as the dependent variable in separate sets of regression runs. Separate

regressions were run for four age groups (45–64, 65–74, 75–84, and 85+), each containing the following independent variables: age, sex, and eight variables representing year of death (coded 0–1) with 1 denoting death in the year of occurrence over the period (1974 through 1982).

Average costs per day in hospital or nursing home were calculated by dividing total Manitoba Health Services Commission payments (including capital repayment) in 1984–1985 to hospitals (or to nursing homes) by the number of days of care produced that year by these institutions. Total payments for office visits and consultations were divided by the total numbers of the visits to obtain average cost per visit.

Results

Hospital Usage

The far-left column of table 1 presents age and sex-specific usage rate for the general population (including survivors and decedents, $N = 52,394$). The next column refers to individuals who survived at least until 1980 ($N = 38,579$). The subsequent columns show hospital utilization prior to death by the 4,263 decedents. Hospital day use increased with age in the two comparison groups, although the relationship appears much stronger in the general population figures containing decedents.

The most dramatic increase in hospital consumption of decedents occurred during their last year of life. Usage for all but the youngest group approximately doubled during the fourth through second year prior to death. In the year before death, however, the hospital utilization of all age groups increased markedly from 7.5 days to 24.8 days for the youngest males and from 15.0 to 39.7 days for the oldest males. Impending death reduced the age differential in hospital-day consumption, particularly for females. Thus, although aging per se was associated with an increased use of hospitals (as seen in the survivor column), the relation between age and utilization disappears for females and for very elderly males in the years prior to death.

The data in table 1 also suggest that there were differences across age groups in the length of time during which impending death

TABLE 1
Hospital Utilization According to Proximity to Death, by Sex and Age: Annual Mean Days of Hospitalization
(Acute and Chronic)

	Comparison groups		Decedents				Total 4 years
	General population	Survivors	4th year prior	3rd year prior	2nd year prior	1st year prior	
Males*							
45-64 years	1.8	1.3	8.3	6.8	7.5	24.8	47.3
65-74	4.8	2.4	6.0	9.9	14.5	36.5	66.9
75-84	9.8	3.8	9.6	13.0	19.4	48.7	90.7
85 +	14.3	5.6	9.0	14.1	15.0	39.7	77.9
Females							
45-64 years	1.8	1.3	16.3	20.8	14.8	42.3	94.1
65-74	4.2	2.4	9.4	16.7	18.9	52.9	97.9
75-84	8.3	3.9	9.8	15.5	18.3	45.4	88.9
85 +	15.9	6.7	14.1	15.2	23.5	44.8	97.6
All	3.8	1.8	10.0	13.4	16.5	41.4	81.4

* Age for population groups is age at July 1, 1975; age for those who died is age at time of death between July 1, 1974 and June 30, 1976. Usage is reported for July 1974 to June 1975 for the population samples. Numbers in each category from youngest to oldest were as follows: (N general population/N survivors/N decedents). Males 8714/7990/175, 8645/6405/595, 6647/3402/980, 2445/604/761. Females 8343/7956/106, 8301/7065/321, 6634/4301/620, 2665/856/705.

influenced health care use. Usage of decedents aged 45 to 74, even when four years away from death, is higher than that of individuals in the general population. Males aged 45 to 64 in the general population averaged 1.8 days of hospitalization per year compared with 8.3 days per year used by decedents of the same age group in the fourth year before their death. Thus, usage of survivors and decedents four years from death differs much more in the youngest age group than in the oldest age group. This suggests a shorter period of increased health care usage prior to death among the oldest decedents.

Given such differences, a series of multiple regressions (one for each age group in table 1) explored the relation between hospital usage and impending death. Controlling for age and sex, among individuals aged 45 to 74 years old, death in each of the eight years (1974 through 1982) was significantly associated with the number of days spent in hospital in 1973 (table 2). For these age groups, impending death influences health care use for at least eight years prior to death. As expected, the strength of the relationship weakened as the time between 1973 usage and year of (possible) death increased. By way of contrast, for those aged 75 to 84, the number of days spent in hospital in 1973 was significantly associated with death in only the six subsequent years, and for the oldest group (those aged 85 years and older) only death in the following year was significantly and positively associated with 1973 usage. In fact, the negative coefficients in table 2 suggest that a life expectancy of four or more years at age 85 (and older) actually produces a decrease in the predicted hospital use at age 85, i.e., these individuals are likely healthier than other 85 year olds. Recognizing the very different sample sizes (over age groups), the regression models were refit, sampling each of the three younger age groups to produce samples equivalent in size to the 85 year olds. The pattern of statistical significance and estimates of regression coefficients was essentially unchanged. These results confirm the data in table 1 suggesting that impending death influences health care usage among the oldest age groups over a much shorter period.

Nursing Home Usage

Table 3 illustrates the strong relation between nursing home use and age. Over the four years before death, very elderly females (those 85 years and older) spent 20.4 times as many days in nursing homes as

TABLE 2
Influence of Number of Years before Impending Death on Hospital Usage

Independent variables	Dependent variable: natural logarithm, (1 + number of days spent in hospital in 1973-1974)			
	Age in 1974			
	45-64 years	65-74 years	75-84 years	85 years and older
Intercept	-.14	-.66	-.77	.35
Age	.01**	.01**	.02**	.01
Sex (male/female)	.05**	.01	-.05*	-.02
Death in:				
1974-1975	1.07**	1.17**	.86**	.16*
1975-1976	.55**	.69**	.48**	.10
1976-1977	.24**	.50**	.26**	-.12
1977-1978	.25**	.43**	.23**	-.18*
1978-1979	.37**	.27**	.18**	-.09
1979-1980	.22**	.24**	.09*	-.36**
1980-1981	.17**	.21**	.03	-.35**
1981-1982	.22**	.10**	-.01	-.20
R ²	.03	.05	.03	.01
N	17,802	17,834	13,021	4,634

* $p < .05$

** $p < .001$

did women aged 45 to 64 (514.9 and 25.2 days respectively). By way of contrast, very elderly decedent females used on average only 4 percent more hospital days over this same four-year period than did women aged 45 to 64 (97.6 versus 94.1—table 1). At every age group, except those aged 45 to 64, females used 80 to 100 percent more nursing home days than males. (This was true to a lesser extent of hospital use for most age groups.) Finally, while the major increase in hospital usage occurred in the year immediately prior to death (suggesting relatively few prolonged illnesses with major consequences to the health care system) this was not the pattern for nursing home utilization. There were large, regular increases in the number of days spent in a nursing home in each of the four years prior to death.

Regression analysis similar to that reported above was undertaken to determine the relation between nursing home usage and impending

TABLE 3
Nursing Home Utilization According to Proximity to Death by Age and Sex*

		Mean days of residence in nursing home						
		Comparison groups		Number of years before death				
		General population	Survivors	4th year prior	3rd year prior	2nd year prior	1st year prior	Total 4 years
Males								
45-64 years	.8	.5	2.4	3.9	7.5	7.2	21.0	
65-74	4.0	2.4	6.4	9.2	10.7	14.9	41.1	
75-84	18.6	7.2	12.2	23.0	39.8	52.8	127.7	
85 +	64.7	30.6	43.2	61.8	85.4	110.8	301.1	
Females								
45-64 years	.7	.5	2.7	3.3	9.5	9.7	25.2	
65-74	6.2	3.8	9.8	15.7	23.7	32.0	81.2	
75-84	33.4	17.7	31.9	49.8	69.7	96.0	247.4	
85 +	107.5	66.2	83.6	114.2	144.2	172.8	514.9	
All	8.5	2.9	25.3	37.0	51.1	64.9	178.4	

* For numbers in each age-sex category see table 1.

TABLE 4
Influence of Number of Years before Impending Death on
Nursing Home Usage

Independent variables	Dependent variable: natural logarithm, (1 + number of days spent in nursing home in 1973-1974)		
	Age in 1974		
	65-74 years	75-84 years	85 years and older
Intercept	-.79	-5.44	-9.78
Age	.01***	.07***	.11***
Sex (male/female)	.06***	.28***	.75***
Death in:			
1974-1975	.30***	.89***	.92***
1975-1976	.28***	.66***	.70***
1976-1977	.22***	.51***	.74***
1977-1978	.22***	.51***	.66***
1978-1979	.20***	.35***	.11
1979-1980	.12***	.22***	.24
1980-1981	.07*	.24***	.36*
1981-1982	.07**	.13*	-.02
R ²	.02	.06	.07
N	17,834	13,021	4,634

* $p < .05$
 ** $p < .01$
 *** $p < .001$

death. Compression of usage associated with death in the oldest age group again occurs but less markedly than with hospital use; among 85 year olds usage of nursing home increases significantly during the four years before death compared with eight years before death for those aged 65 to 84 (table 4).

Physician Visits

Table 5 presents data on ambulatory visits to physicians in the four years before death by individuals who were never admitted to a nursing home. Including nursing home residents would tend to underestimate physician contact since nursing homes frequently have salaried contracts with physicians whose visits to residents would not be recorded in

TABLE 5
Ambulatory Visits to Physicians in the Four Years before Death by Age and Sex*

	Annual mean number of physician visits**						Total 4 years
	Comparison groups		Decedents				
	General population	Survivors	4th year prior	3rd year prior	2nd year prior	1st year prior	
Males							
45-64 years	3.7	3.6	6.0	6.1	7.9	9.5	29.6
65-74	4.8	4.4	5.0	5.8	6.5	9.8	27.2
75-84	5.2	4.9	5.3	5.5	6.0	7.9	24.7
85 +	4.6	4.4	4.4	4.9	4.9	6.3	20.4
Females							
45-64 years	5.0	4.9	5.9	7.0	6.7	8.6	28.2
65-74	5.6	5.4	6.2	6.6	7.3	9.6	29.6
75-84	5.7	5.5	5.6	5.7	6.3	7.6	25.2
85 +	4.4	4.8	4.7	4.3	4.5	5.2	18.7
All	4.7	4.5	5.4	5.8	6.4	8.4	26.0

* Only individuals never admitted to nursing homes in the four years before death are included in this table. For individuals with no deaths, physician usage in 1974-75 is presented. Numbers available in each category from youngest to oldest were as follows: (N no deaths/N deaths) males 7918/172, 6360/561, 3317/784, 547/483. Females 7943/103, 6976/282, 4058/419, 680/324.

** Includes office, outpatient and emergency room.

TABLE 6
 Estimates of Elderly's Health Care Use in the Year 2000 Based on Two
 Types of Projections*

	Hospital usage		Nursing home usage	
	Days in 1000s	(Percentage increase year 2000/ year 1976)	Days in 1000s	(Percentage increase year 2000/ year 1976)
Usage in year 1976	766	—	2,204	—
Projected usage				
Year 2000:				
Based on mean rates	1,325	(73%)	4,282	(94%)
Based on decedent/ survivor-specific rates	1,257	(64%)	4,305	(95%)

* See appendix for details on calculations.

the claims system. The mean number of physician visits for the comparison groups differs relatively little across age and sex categories. In marked contrast to the institutional data, an inverse relation between physician usage and age was found for both males and females; in every year before death, the very elderly made fewer visits to physicians than did those aged 45 to 64 years.

Declining Mortality Rates and Usage Projections

To date, projections of health care usage have relied almost exclusively on straight-line projections of "mean" usage rates rather than on separate calculations based on numbers and usage of survivors and decedents. Full details on the methods by which the two different projections have been made are contained in the appendix.

Table 6 summarizes these two different projections, focusing first on hospital usage and then on nursing home usage. Thus, in 1976, the Manitoba elderly population (those aged 65 years and older) spent 766,000 days in hospitals and 2,204,000 days in nursing homes. Based on the projected growth in the number of elderly by the year 2000 and taking mean age and sex-specific usage rates for 1976 (i.e.,

assuming no change in usage), by the year 2000 Manitoba elderly would be expected to use 1,325,000 hospital days, a 73 percent increase in usage. A projection based on the numbers of elderly decedents and survivors in the year 2000, however, suggests somewhat lower usage (1,257,000 days), a 64 percent increase. Although declines in elderly mortality rates offset projected increases in hospitalization somewhat, nursing home use is much more strongly related to aging than to dying. Thus, the two projections of nursing home use are very similar for the year 2000 (4,282,000 versus 4,305,000 days).

Total System Use of Very Elderly Decedents

Table 7 summarizes total health care usage and provides a rough estimate of total health system expenditures on the elderly in the four years prior to death. Since Manitoba hospitals are funded on a global budget basis, calculating actual expenditures is difficult. In 1984–1985 hospital costs (Canadian dollars) were estimated to be \$322 per day, nursing home costs \$49 per day (an additional 25 percent is paid by the individual), and average cost per physician visit, \$17.

Usage figures in table 7 are combined for males and females to simplify the presentation. Thus, 45 to 64 year olds spent on average 65.2 days in hospital in the four years prior to death at a mean expenditure per decedent of \$21,000. The total estimate of health care expenditures per decedent in the four years before death varies from \$23,600 in the youngest age group to \$49,400 per person in the oldest age group. While the figures on usage are accurate, the expenditure figures must be treated with caution. Our own research has demonstrated that days spent in hospital by the very elderly (as compared with days spent by younger individuals) are more likely to be spent in small rural hospitals (rather than expensive high-technology teaching hospitals) and in long custodial stays (Roos, Flowerdew, Wajda, and Tate 1986). Using mean expenditures figures for use by the very elderly of hospitals very likely overestimates costs.

The Low User Group

Finally, it is important to identify the individuals who make few demands on the health care system. Table 8 separates individuals into those who spent two weeks or less in a hospital or nursing home

TABLE 7
Total Health Care Usage and Expenditures in the Four Years before Death*

	Four-year mean figures for decedents		
	Mean use in 4 years before death days/visit	Mean total \$ of expenditures estimate (1000s)	Mean total \$ expenditures (1000s)
45-64 year olds			
Physician visits	29.0	1.5	
Days in hospital	65.2	21.0	
Days in nursing home	22.6	1.1	
Total			23.6
65-74			
Physician visits	28.0	.5	
Days in hospital	78.2	25.2	
Days in nursing home	55.7	2.7	
Total			28.4
75-84			
Physician visits	24.9	.4	
Days in hospital	89.9	28.9	
Days in nursing home	181.8	8.9	
Total			38.2
85+			
Physician visits	19.6	.3	
Days in hospital	88.7	28.6	
Days in nursing home	419.3	20.5	
Total			49.4
All			
Physician visits	26.0	.4	
Days in hospital	81.4	26.2	
Days in nursing home	178.4	8.7	
Total			35.3

* Expenditures are estimated in 1984-85 Canadian dollars as follows: \$322 per hospital day, \$49 per nursing home day, \$17 per physician visit.

TABLE 8
Decedents by Number of Days Spent in Hospital and/or Nursing Home in
the Year Prior to Death (Percentage by Age in Each Day Group)*

	Number of days in institution		
	0-14	15-29	30+
Males			
45-64	57.8	13.0	29.2
65-74	44.7	16.2	39.1
75-84	33.2	13.2	53.6
85+	29.6	10.1	60.4
Females			
45-64	41.5	12.3	46.3
65-74	36.9	9.6	53.5
75-84	25.7	9.6	64.7
85+	18.7	7.3	74.0
All	35.8	11.6	52.6

* For numbers available in each sex and age group see table 1—decedents.

during the year in which they died, those who spent 15 to 29 days in either site, and all others. Overall, 35.8 percent of decedents spent two weeks or less in any institution. These individuals, in fact, averaged less than a day in a nursing home and only 3.5 days in a hospital in the year before death. This group included 29.6 percent of the very elderly males and 18.7 percent of the very elderly females.

Individuals in the low-user group were much more likely to die of acute myocardial infarction (AMI) than was the population generally (29.6 percent versus 18.2 percent—Table 9). For most individuals these deaths, as well as deaths from accidents, would be considered premature. For most other causes of death there were no striking differences between the low-user group and the population generally. Among the very elderly low-user group, AMI was somewhat less frequently listed as cause of death, while cerebrovascular disease and "other causes" were listed somewhat more frequently. Clearly, a substantial number of elderly individuals die without a prolonged period of illness and disability, or at least their deaths do not place major demands on a health care system which has few barriers to utilization by the elderly.

TABLE 9
Cause of Death in the Low-user Group (Percentage in Each Cause of Death Group by Age)*

Cause of death	Age of low users				All low users	All deaths
	45-64 years	65-74 years	75-84 years	85 years and older		
Malignancy of respiratory system	.8	5.2	2.6	1.6	2.6	4.7
Malignancy of digestive organs	2.9	5.3	3.5	2.4	3.6	7.7
Other malignancies	5.8	3.9	3.3	3.6	4.3	10.0
Acute myocardial infarction	33.2	32.5	29.1	19.2	29.6	18.2
Chronic ischemic heart disease	8.3	10.5	13.1	12.5	10.7	10.9
Cerebrovascular disease	3.3	8.7	9.0	11.9	7.6	10.1
Other forms of heart disease	6.3	10.4	10.9	11.6	9.5	11.4
Pneumonia	3.0	3.5	2.7	3.9	3.2	5.0
Other disease of respiratory system	4.5	3.8	3.6	4.0	4.0	4.2
Accidents, poisonings and violence	9.2	4.1	2.8	2.6	5.2	3.1
Other	10.3	5.4	7.6	6.7	7.7	9.8
Unknown	12.3	6.8	11.8	20.0	12.0	5.0

* Numbers of low users in each age group from youngest to oldest were: 144, 385, 480, 358.

Discussion

The data used here have several important characteristics: first, they are population-based and include large numbers of the very elderly, a group of special interest for whom data are rarely available (Suzman and Riley 1985). Second, they represent high-quality utilization data from an administrative system. Biases resulting from basing utilization estimates on recall, proxies, and so forth are absent (Cohen and Burt 1985). Third, these data are from a system in which all major elements of care (hospitalizations, physician visits, and nursing home stays) were fully covered for all age groups by universal insurance without

deductibles or co-payments. (A per diem charge to nursing home residents is levied for room and board but this charge is maintained at a level at which the lowest income pensioners can pay and still have some disposable income left for personal expenditures.)

The Manitoba health care system in some key aspects is similar to that of the United States. Physicians are paid on a fee-for-service system and physicians move freely between hospital and community practice. Supplies of both hospital beds and nursing home beds are somewhat greater in Manitoba (5.5 general medical and surgical beds in Manitoba per 1,000 people compared with 5.0 in the United States, and 6.7 nursing home beds per 1,000 population 65 years and older versus 6.1 in the United States).

One area of contrast between the two systems is that of nursing home usage. Whereas United States nursing homes admit short-term patients for rehabilitative and convalescent care, in Manitoba such care is accommodated through longer hospital stays, by transfer to extended (chronic) treatment facilities, or through home care. About 95 percent of patients admitted to Manitoba nursing homes never again live outside an institution. Thus, Manitobans enter nursing homes at a much older age and remain longer than individuals admitted to nursing homes in the United States (Shapiro and Webster 1984). Manitoba usage patterns might be considered to represent a comprehensive system of care unaffected by the payment source and length-of-stay restrictions which influence United States usage patterns (Kane and Kane 1985; Liu and Manton 1983).

Despite these differences, the potential generalizability of the Manitoba data are enhanced by the degree to which they confirm results reported by other researchers. In Manitoba as in the United States, hospital utilization markedly increases in a short period before death, dying has a greater impact on utilization than aging per se, and small numbers of individuals consume a disproportionate amount of care. Also, in Manitoba as in the United States, very elderly decedents spend somewhat fewer days in hospital and make fewer physician visits than those dying at younger ages. Our analysis provides some evidence for the apparent "compression of morbidity in older age groups" suggested by Lubitz and Prihoda (1984). They suggest that the time between onset of illness and death may be shorter for older decedents.

Our analyses, however, based on this comprehensive data set, do

not confirm previous findings that those dying at older ages have less expensive rather than more expensive deaths (Lubitz and Prihoda 1984). At least in a system such as that in Manitoba where all elements of health care are insured, deaths of those 85 years and older result in health care expenditures approximately 31 percent higher than deaths of individuals aged 75 to 84, and 79 percent higher than those of individuals aged 65 to 74. Since the major difference in cost between those dying at different ages is in nursing home expenditures, it is unlikely that even a substantial overestimation of hospital expenditures of the very elderly would alter this observation.

Despite the impact of nursing home expenditures on health care costs of elderly decedents, it is only in this oldest group that nursing home expenditures likely come even close to approximating those of hospital expenditures. Given hospitals' key role in caring for individuals with fatal illness, such findings are not surprising.

These data show that in the mid-1970s significant numbers of very elderly individuals died what might be characterized as "natural deaths"—or at least deaths with few consequences for the health care system. Fries (1980) hypothesizes that the numbers of these individuals will greatly increase over time. We will replicate these analyses on more recent cohorts to determine if in the 1980s the proportion of elderly dying with few health care demands has increased.

Finally, declines in the elderly's mortality rates in the year 2000 may slightly offset projected increases in health care expenditures necessary to care for an aging population. Projections of use based on "mean" rates do somewhat overestimate the amount of health care "needed" in the future. However, whether one projects an increased use of 73 percent more hospital days in the year 2000 or 64 percent, these projections are based on patterns of use, and use is not necessarily an accurate reflection of health care "needs."

A large literature suggests that use is influenced by many factors other than patient need, including the availability of hospital and nursing home beds and physician discretion in the decision to hospitalize (Wennberg, Barnes, and Zubkoff 1982; Roos, Flowerdew, Wajda, and Tate 1986). The ability of existing health care systems to adapt to increased numbers of elderly without expanding acute-care beds is found in Manitoba. Thus, despite an increase in the number of elderly in the 1970s (age-sex specific projections of use predicted an 8.3 percent increase in utilization between 1970 and 1981), the number

of hospital days used by the Manitoba population actually decreased—6.3 percent on a per thousand population basis (Roch, Evans, and Pascoe 1985). This decrease reflected an administrative decision to reduce the numbers of hospital beds in certain areas over this period. A similar pattern was found in British Columbia where acute hospital usage fell markedly in the 1970s despite a rapidly aging population (Barer et al. 1987). Thus, the health care system is potentially malleable. Manitoba built nursing home beds in the 1970s and currently plans to increase capacity for “not for admission surgery” and home care as alternatives to expanding the acute care sector.

Conclusion

To conclude, those dying at older ages have more rather than less expensive deaths, largely due to heavy nursing home use by the very elderly, at least in a health care system with no financial barriers to access nor usage limitations. Despite this “bad news”, however, declines in elderly mortality rates will somewhat offset projected increases in hospital usage, and even in the 1970s there was a substantial group of individuals in every age group, even among the very elderly, whose deaths had few consequences to the health care system. Further work is needed to delineate the effects of more recent developments in geriatric care (e.g., expanded home care, geriatric units) and the passage of time (as predicted by Fries) upon the consumption of health care by our rapidly aging population.

Appendix

To estimate the impact that changing age structures and changing mortality rates have on projections of health care usage for the elderly, age and sex-specific death rates for the year 1968 and the year 2000 were used to estimate age-specific death rates in 1976 (Rice and Feldman 1983). Estimates of the number of Manitobans in 1976 and the year 2000 by age-sex group were obtained from Statistics Canada (1980). Utilization rates for individuals surviving the period July 1, 1974 to June 30, 1975 (column F) were taken from the 60,000 sample as were utilization rates for individuals dying during the period

APPENDIX TABLE 1
 Projections of Hospital Usage in the Year 2000 Using Decedent/Survivor-Specific Versus Mean-usage Rates

Year	A Numbers in each age group	B Mortality rate in each group	C Number dying in each age group	D Age/sex- specific mean days of hospitalization	E Mean days of hospitalization among decedents	F Mean days of hospitalization among survivors	G Total hospital days assuming mean usage rate in 2000 is the same as in 1976 (000s)	H Total hospital days assuming decedent/survivor usage rates in 2000 are the same as in 1976 (000s)
			(B*A)	$\frac{((E*C) + (F*(A - C)))}{A}$			D*A/1000	$\frac{((E*C) + (F*(A - C)))}{1000}$
1976								
Males								
65-69	17,500	.038	665	4.23	26.02	3.37	74	74
70-74	13,000	.056	728	6.91	23.42	5.93	90	90
75-79	8,300	.083	689	8.79	31.73	6.71	73	73
80-84	5,100	.119	607	12.55	34.18	9.63	64	64
85 +	4,000	.195	780	14.33	22.81	12.27	57	57

(column E). Since age/sex-specific utilization rates are just the mean usage for decedents times the number of decedents plus the mean usage of survivors times the number of survivors, these rates were calculated directly (column D). The three sets of utilization rates (columns D through F) were then applied to the population distribution expected to exist in the year 2000 (bottom half of table—columns A through C). Projections based on the age-specific rates resulted in 1,325,000 total expected hospital days in the year 2000 (column G) compared to 1,257,000 days projected using decedent/survivor user rates (column H). Projections for nursing home use were made in the same way, substituting nursing home usage rates for survivors and decedents for the period July 1974 through June 1975 obtained from the 60,000 sample.

References

- Barer, M.L., R.G. Evans, C. Hertzman, and J. Lomas. 1987. Toward Efficient Aging: Rhetoric and Evidence. In *Aging with Limited Resources*, ed. Economic Council of Canada. Ottawa.
- Cohen, S.B., and V.L. Burt. 1985. Data Collection Frequency Effect in the National Medical Care Expenditure Survey. *Journal of Economic and Social Measurement* 13:125–51.
- Fisher, C.R.. 1980. Differences by Age Groups in Health Care Spending. *Health Care Financing Review* 1:65–90.
- Fries, J.F. 1980. Aging, Natural Death, and the Compression of Morbidity. *New England Journal of Medicine* 303:130–35.
- Fuchs, V.R. 1984. "Though Much Is Taken": Reflections on Aging, Health, and Medical Care. *Milbank Memorial Fund Quarterly/Health and Society* 62(2):143–66.
- Gross, M.J., and C.W. Schwenger. 1981. *Health Care Costs for the Elderly in Ontario: 1976–2026*. Occasional Paper 2, Ottawa: Ontario Economic Council.
- Kane, R.L., and R.A. Kane. 1985. *A Will and a Way. What the United States Can Learn from Canada about Caring for the Elderly*. New York: Columbia University Press.
- Liu, K., and K.G. Manton. 1983. The Characteristics and Utilization Pattern of an Admission Cohort of Nursing Home Patients. *Gerontologist* 23:92–98.
- Lubitz, J., and R. Prihoda. 1984. The Use and Costs of Medicare Services in the Last Two Years of Life. *Health Care Financing Review* 5:117–31.

- McCall, N. 1984. Utilization and Costs of Medicare Services by Beneficiaries in Their Last Year of Life. *Medical Care* 22:329–42.
- Rice, D.P., and J.J. Feldman. 1983. Living Longer in the United States: Demographic Changes and Health Needs of the Elderly. *Milbank Memorial Fund Quarterly/Health and Society* 61(3):362–96.
- Riley, G., J. Lubitz, R. Prihoda, and M.A. Stevenson. 1986. Changes in Distribution of Medicare Expenditures among Aged Enrollees, 1969–82. *Health Care Financing Review* 7:53–64.
- Roch, D., R.G. Evans, and D. Pascoe. 1985. *Manitoba and Medicare, 1971 to the Present*. Winnipeg: Manitoba Health.
- Roos, L.L., N.P. Roos, S.M. Cageorge, and J.P. Nicol. 1982. How Good Are the Data?: Reliability of One Health Care Data Bank. *Medical Care* 20:266–76.
- Roos, L.L., A. Wajda, and J.P. Nicol. 1986. The Art and Science of Record Linkage: Methods That Work with Few Identifiers. *Computers in Biology and Medicine* 16:45–57.
- Roos, N.P., G. Flowerdew, A. Wajda, and R.B. Tate. 1986. Variations in Physicians' Hospitalization Practices: A Population-based Study in Manitoba, Canada. *American Journal of Public Health* 76(1):45–51.
- Roos, N.P., E. Shapiro, and B.J. Havens. 1987. Aging with Limited Resources: What Should We Really Be Worried About? In *Aging with Limited Resources*, ed. Economic Council of Canada. Ottawa.
- Scitovsky, A.A. 1984. "The High Cost of Dying": What Do the Data Show? *Milbank Memorial Fund Quarterly/Health and Society* 62(4):591–608.
- Shapiro, E., and L.M. Webster. 1984. Nursing Home Utilization Patterns for All Manitoba Admissions, 1974–1981. *Gerontologist* 24:610–15.
- Statistics Canada. 1980. *Population Projections for Canada and the Provinces: 1976–2001*. Ottawa: Health and Welfare Canada.
- Suzman, R., and M.W. Riley. 1985. Introducing the "Oldest Old." *Milbank Memorial Fund Quarterly/Health and Society* 63(2):177–86.
- Wennberg, J.E., B.A. Barnes, and M. Zubkoff. 1982. Professional Uncertainty and the Problem of Supplier Induced Demand. *Social Science and Medicine* 16:811–24.

Acknowledgments: This research was supported by grants #6607-1197-44 and #6607-1157-46 from the Research Programs Directorate, Health and Welfare Canada, Career Scientist Awards #6607-1001-22 and #6606-1114-48 to the first and third authors and a grant from the St. Boniface General Hospital Research Foundation #RF85-5. The authors are indebted to the Manitoba

Health Services Commission, the Manitoba Department of Community Services, Vital Statistics and the Vital Statistics and Disease Registries Section, Statistics Canada for making this research possible. Interpretations of the data are the authors' own and do not necessarily represent the official opinion of the supporting agencies. The comments of the anonymous reviewers are acknowledged with thanks, as is the assistance of Karen Hammarstrand, Carmen Steinbach, Bogdan Bogdanovic and Debbie Doan in the preparation of the manuscript.

Address correspondence to: Noralou P. Roos, Ph.D., Department of Social and Preventive Medicine, The University of Manitoba, S101A-E - 750 Bannatyne Avenue, Winnipeg, Manitoba, Canada R3E 0W3.